

## Oroville Facilities Relicensing Project

(FERC PROJECT NO. 2100)

# DRAFT REPORT SP-W5, Task 1, Phase 1

## SPW5. PROJECT EFFECTS ON GROUNDWATER TASK 1, PHASE 1. INVENTORY EXISTING WELLS AND ASSESSMENT OF EXISTING GROUNDWATER DATA AND CURRENT GROUNDWATER MONITORING ACTIVITIES

**REVIEW DRAFT**

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**Oroville Facilities Relicensing Project**  
**Environmental Work Group**

**SPW5. Project Effects on Groundwater**

**Task 1, Phase 1. Inventory Existing Wells and Assessment of Existing Groundwater Data and Current Groundwater Monitoring Activities**

## **1.0 Summary**

The Environmental Work Group developed a study plan to identify possible effects to groundwater levels and quality from project facilities and operations. Task 1 of that study plan included determining whether existing data are sufficient to evaluate potential project effects to groundwater. This report presents the results of the evaluation of existing data.

Local geology essentially eliminates potential effects to groundwater from Lake Oroville, which is underlain by relatively impermeable Mesozoic-era igneous and metamorphic bedrock.. The Thermalito Forebay and Afterbay, however, are underlain by younger and more permeable volcaniclastic and consolidated alluvial sediments where groundwater recharge occurs, thus potentially affecting local groundwater.

Wells previously monitored in the vicinity of the Thermalito Forebay show that project operation raised the groundwater level about ten feet. However, no groundwater quality data are available from this area.

Numerous wells are present in the vicinity of the Thermalito Afterbay, but most of these are actively pumping wells and, therefore, unsuitable for measuring groundwater levels. DWR monitors several wells in the vicinity of the Afterbay, but most of these are too far from the project to be useful for determination of project effects. Some previously monitored wells nearer the project were located and have been added to the monitoring grid, but additional wells are necessary to provide sufficient areal coverage and resolution for groundwater contours and flow gradient determinations. Similarly, only two wells near the project have been monitored for water quality, but the depth from which one well draws water is unknown and the other well is over a mile from the Afterbay. Thus, additional wells will need to be monitored to determine project effects to groundwater quality.

## **2.0 Introduction/Background**

Relicensing participants raised a concern about the effects of project features and operations on groundwater quality downstream from project facilities. Existing and future operation of the Oroville Facilities may have effects on the physical, chemical, and biological components of groundwater quality in the project area. Some physical, chemical, and biological data have been collected from groundwater in the project area. However, these data are not, nor were they expected to be, sufficient to determine compliance with Basin Plan criteria, goals, and objectives (CVRWQCB 1998) established for protection of groundwater beneficial uses. Additional physical, chemical, and biological data are needed to demonstrate project compliance with Basin Plan standards for groundwater.

Oroville Dam and Lake Oroville are underlain by relatively impermeable Mesozoic-era igneous and metamorphic bedrock, which should eliminate any groundwater effects from Lake Oroville. Downstream from the dam, the Feather River and the Thermalito Forebay and Afterbay project features are on much younger and more permeable volcaniclastic and consolidated alluvial sediments, where groundwater recharge occurs. This area is an older upland adjacent to the basin to the west. Due to the porosity of the underlying

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deposits, hydraulic heads of the Thermalito Forebay and Afterbay surface water features, as well as varied project-related releases to the Feather River, the Forebay and Afterbay probably contribute to locally higher groundwater levels, though the extent of this effect has not been quantified. It is possible also that groundwater quality locally reflects the characteristics of the water within these project features. To the west of the uplands are the younger alluvial deposits of the Sacramento Valley. At least two aquifer systems have been identified in the valley system. How all three systems interact is not known.

A study plan was developed and approved by the Environmental Workgroup to evaluate the effects from project facilities and operations on groundwater levels and quality. Task 1, Phase 1 of that study plan was to determine whether existing data are sufficient to evaluate potential effects from project facilities and operations on groundwater levels and quality in the project area and develop appropriate monitoring. This report presents the results of that task.

### **3.0 Study Objective**

The objectives of this study task are to quantify the localized effects on groundwater levels and groundwater quality from Thermalito Forebay and Afterbay operations.

### **4.0 Study Area**

The study includes areas where groundwater is anticipated to be affected by project features as well as reference sites up gradient from potential project effects. These include areas adjacent to the west and south of the Thermalito Forebay, and areas adjacent to the west, south and east of the Thermalito Afterbay.

### **5.0 General Approach**

This study evaluates effects from project features to groundwater levels and quality in the vicinity of the Thermalito Forebay and Afterbay. This first phase was to review current groundwater monitoring data to evaluate project effects to groundwater, and, if sufficient data are not available, develop a study plan for a subsequent phase to obtain the necessary information.

An inventory of wells located in the specified field areas was made utilizing records maintained at the California Department of Water Resources (DWR). Potential impacts to groundwater from the Thermalito project features would likely occur in a shallow, unconfined setting. Therefore, wells were grouped as shallow (100 feet deep or less) or deeper. Data for well location, surface elevation, depth, design, and use were entered into a GIS database. The groundwater level and quality data from the wells was reviewed to determine localized effects on groundwater from the Thermalito Forebay and Afterbay, or whether additional data are needed.

### **6.0 Results and Discussion**

**Existing Groundwater Infrastructure** – Groundwater flows in a south-southwest direction in the vicinity of the Thermalito Forebay and Afterbay. About 162 wells (Figure 1) within a two-mile radius down gradient from the Thermalito Afterbay were identified based on the Northern District DWR well log data base, which may not include all wells existing in the area. However, the available data do indicate the relative density and distribution of wells in the area. The wells were mapped with a GIS application, which places each well data point into a one mile square section location indicated on the water well driller's report. Wells were not field located for this evaluation. There are about 63 irrigation wells, 81 domestic wells, and 18 in an "other"

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category, which includes monitoring, municipal, and an “unknown” use designation. Wells range in depth between 15 and 745 feet with an average depth of 131 feet. Of the 162 wells, 86 are up to 100 feet in depth and 76 are greater than 100 feet in depth.

The lithology indicated on water well driller’s reports was reviewed to evaluate the aquifer materials encountered in wells in the area. That review shows that there is a high degree of vertical and horizontal variability of aquifer materials. Aquifer zones are not uniform in thickness, nor is there much uniformity in the depth that different aquifer materials are encountered in area wells. Therefore, it is too simplistic to divide the total aquifer system into the initial 0 to 100 and greater than 100 foot zones called for in the study plan. Many well reports indicate that there are at least two water bodies: a confined zone and an unconfined zone. The aquifer system may also include a semi-confined character but the well log data are insufficient on which to base that determination.

The complexity of the areal and depth distribution of aquifer materials is due to the location of the environment in which the sediments forming the aquifers were deposited. The Afterbay was constructed on an older, dissected upland, consisting of coarse gravels cemented in a sandy clay matrix. The upland area is adjacent to the edge of the groundwater basin to the west where younger alluvial materials overlap the older sediments. The younger sediments consist of alluvial fan, stream, and basin deposits. At the toe of the Afterbay is an alluvial fan complex that is crisscrossed by small distributary streams. These streams trend into the basin in a south to south-southwest direction. Trending from east to west, the younger deposits transition from coarse to fine. In the subsurface, the fine clay materials of the basin deposits interfinger with the coarser sands and gravels of the alluvial fans and stream deposits. The resulting form of the local aquifer system is an irregular wedge of alluvial fan deposits juxtaposed against the older gravels to the east and the younger clays to the west.

**Existing Groundwater Level Monitoring** – The Northern District’s current groundwater level monitoring grid in the area adjacent to the Thermalito Forebay and Afterbay was mapped to help evaluate the adequacy of data coverage. There are only thirteen monthly or semi-annual wells currently being monitored for groundwater level in the area (Figure 2). Many of the wells are too far from the project facilities to provide useful information, and large areas have little to no monitoring coverage.

Two wells potentially affected by the Thermalito Forebay had been monitored for water levels from 1959 to 1982. These wells show that groundwater elevation was increased by about 10 feet following project completion in 1969 (Figure 3).

The water level data from wells near the Thermalito Afterbay are insufficient to develop groundwater contour maps that have enough detail to show the possible effects of the project on the surrounding area. Local area pumping, loading of canals, flooding of fields, and back-pumping at the toe of the Afterbay all provide significant background noise.

A monitoring program was developed by DWR after completion of the project to evaluate water levels and pore pressures in the embankment impounding the Afterbay. A series of piezometers was placed along or near the Afterbay embankment and are monitored on a weekly, bi-weekly, or monthly basis. However, the data from these piezometers are not appropriate to use in contouring area groundwater levels since the data may merely indicate leakage from the Afterbay rather than area groundwater levels and back-pumping at the Afterbay affect the data.

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Northern District staff made several attempts to field locate the numerous piezometers located to the west and southwest of the Afterbay that had been abandoned by DWR. Twelve of these piezometers were located and added to the Northern District monthly monitoring grid. These piezometers will provide some limited data, but additional monitoring wells will be required to provide sufficient areal extent and resolution for groundwater elevation contours and flow gradient determinations.

**Existing Groundwater Quality Monitoring** – Thirteen wells have been monitored for water quality in the area (Figure 4). However, since groundwater in the area moves in a south-southwesterly direction, the project has the potential to affect only two of the wells that have been previously monitored within a mile of the project. Available water quality data are very limited for these two wells, as well as others in the area. Nutrients and metals data are only available from one of the wells (12G01). Minerals have been sampled only once from well 24A01, but several times both prior to and following project construction from well 12G01. Pre- and post-project mineral data from this well are similar, though nitrate levels may be somewhat higher in data collected since project completion. Similarly, physical data have been collected only once from well 24A01, but both prior to and subsequent to project construction from well 12G01. Conductivity was generally less in this well prior to project completion, but also ranged in pre-project samples as high as levels found in post-project samples.

Minerals were present at much greater levels in the only sample collected from well 24A01 than from samples collected from the Afterbay. Minerals in well 12G01, with the exception of potassium, were also present at much greater levels than from the Afterbay, but, with the exception of sulfate and chloride, were at lower levels than found in well 24A01. Samples for other constituents (nutrients, minor elements) were too few for comparison.

While well 24A01 is adjacent to the Afterbay, well 12G01 is over a mile away, which, lacking data from other wells closer to the Afterbay, makes use of this well questionable to determine any effects from the project. The paucity of data from only two wells, one of which is over a mile from the project, makes meaningful determinations about project effects on groundwater quality impossible to ascertain.

Though groundwater level data indicate that the project has had a significant effect on water elevations in the vicinity of the Thermalito Forebay, no water quality data are available to determine effects to local groundwater quality from the project.

An accurate determination of project effects on groundwater quality cannot reliably be made due to the paucity of groundwater quality data in the immediate vicinity of the Thermalito Forebay and Afterbay. Most of the wells that have been previously monitored are several miles from the project, and the few wells nearer the project lack sufficient water quality data for determination of project effects.

**Phase Two Groundwater Monitoring** – The wells previously monitored in the vicinity of the Thermalito Forebay clearly indicate the effects of the project on groundwater levels. Evaluation of the existing monitoring network makes it clear that additional monitoring wells will be required to make an adequate estimation of the influence of the Thermalito Afterbay on local groundwater levels. Determination of any effects from the Thermalito Afterbay on surrounding groundwater elevations will require a grid of wells with known construction located throughout the potentially affected area. Though numerous wells have been identified in the area, most of these are unsuitable for monitoring groundwater levels since they have unknown construction, are of unknown depth, may penetrate more than one aquifer for which the interaction is unknown, or are active pumping wells for irrigation or domestic use.

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Approximately 9 to 12 additional dedicated monitoring wells are suggested for installation to the west and southwest of the Afterbay to provide sufficient areal coverage where data are not currently available. Double completion wells should be installed at several sites to monitor the hydrologic connection between shallow and deeper aquifer zones.

Because the area under investigation is extremely flat, an elevation survey with a high level of accuracy is necessary to obtain adequate vertical control on groundwater level elevations, both for contouring and for determining flow directions and gradients. A level survey should be conducted to establish the ground and reference point elevations at each monitoring well site. The survey should include existing monitoring wells and the proposed new monitoring wells.

Due to the paucity of groundwater quality data in the project area, additional data are needed before effects from the project on groundwater quality can be evaluated. Additional groundwater quality data should be collected in the vicinity of both the Thermalito Forebay and Afterbay. This will include routine sampling of previously monitored wells in the vicinity of the project, sampling other wells closer to the project itself, and sampling any wells developed to monitor groundwater levels.

Groundwater levels and quality will be measured in monitoring wells and piezometers. Active pumping wells will not be measured or sampled for water level, but may be included for water quality measurements. Groundwater levels will be measured monthly, while groundwater quality sampling will be conducted in the spring and fall.

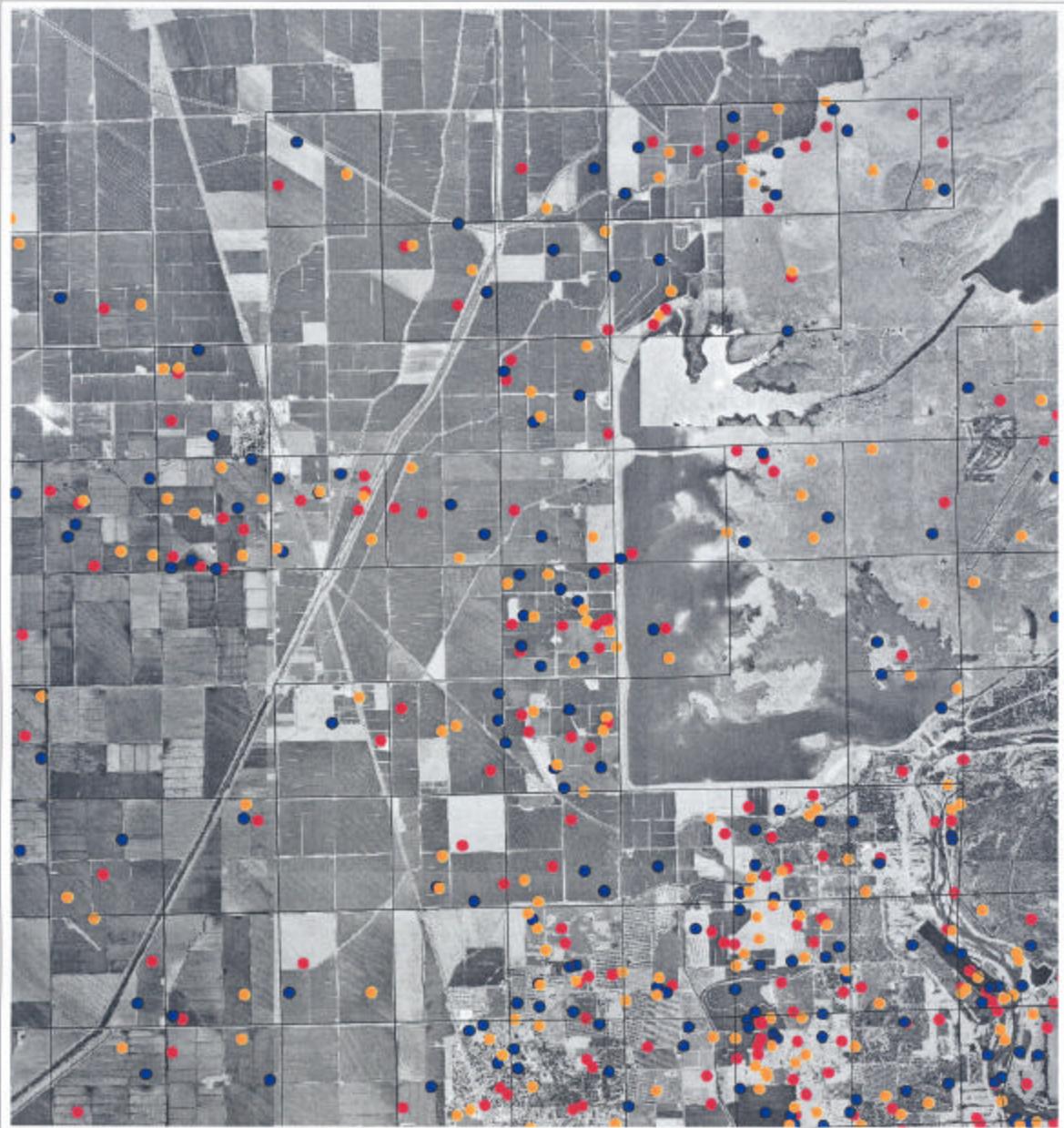
Groundwater samples collected for additional monitoring will be analyzed for general mineral composition and physical parameters including pH, conductivity, and temperature at the time of sampling. The general mineral analysis will enable the ionic composition of the groundwater to be compared with the ionic signature of water collected from the Thermalito features in Study Plan SPW1. Similarly, the physical parameters of the groundwater samples can be compared to surface water samples from the Thermalito features.

Additional parameters may also be selected for groundwater monitoring if they are found in the Forebay or Afterbay in significant levels. These parameters may include methyl tert-butyl ether (MTBE), total and fecal coliform bacteria, metals, and select pesticides. Water quality data from SPW1 for the Forebay and Afterbay will be evaluated to determine which additional parameters may also be analyzed from groundwater samples. All chemical analyses would be performed at the DWR Bryte Chemical Laboratory in West Sacramento, California. Analyses for coliform bacteria would be conducted at the DWR laboratory in Red Bluff, California.

## **7.0 Report**

A report will be prepared following the conclusion of the second phase in which all data are presented in appendices, and the potential affects of the Thermalito Forebay and Afterbay on groundwater levels and quality are assessed. The report will contain tables, graphs, figures, and maps, and will include evaluation of the groundwater influences of Thermalito project waters on groundwater levels and quality. Groundwater level and quality data collection would begin in the spring of 2003, and may continue through the fall of 2004.

A report would be completed in 2004 following data collection activities.



**OROVILLE RELICENCING PROJECT**  
**Thermalito Afterbay Area Groundwater Wells**

**Legend**

- Irrigation Wells
- Domestic Wells
- Other Wells

Comment: Wells are located by section and do not represent actual locations.  
Date: January 2003



Figure 1. Wells in the vicinity of the Thermalito Forebay and Afterbay

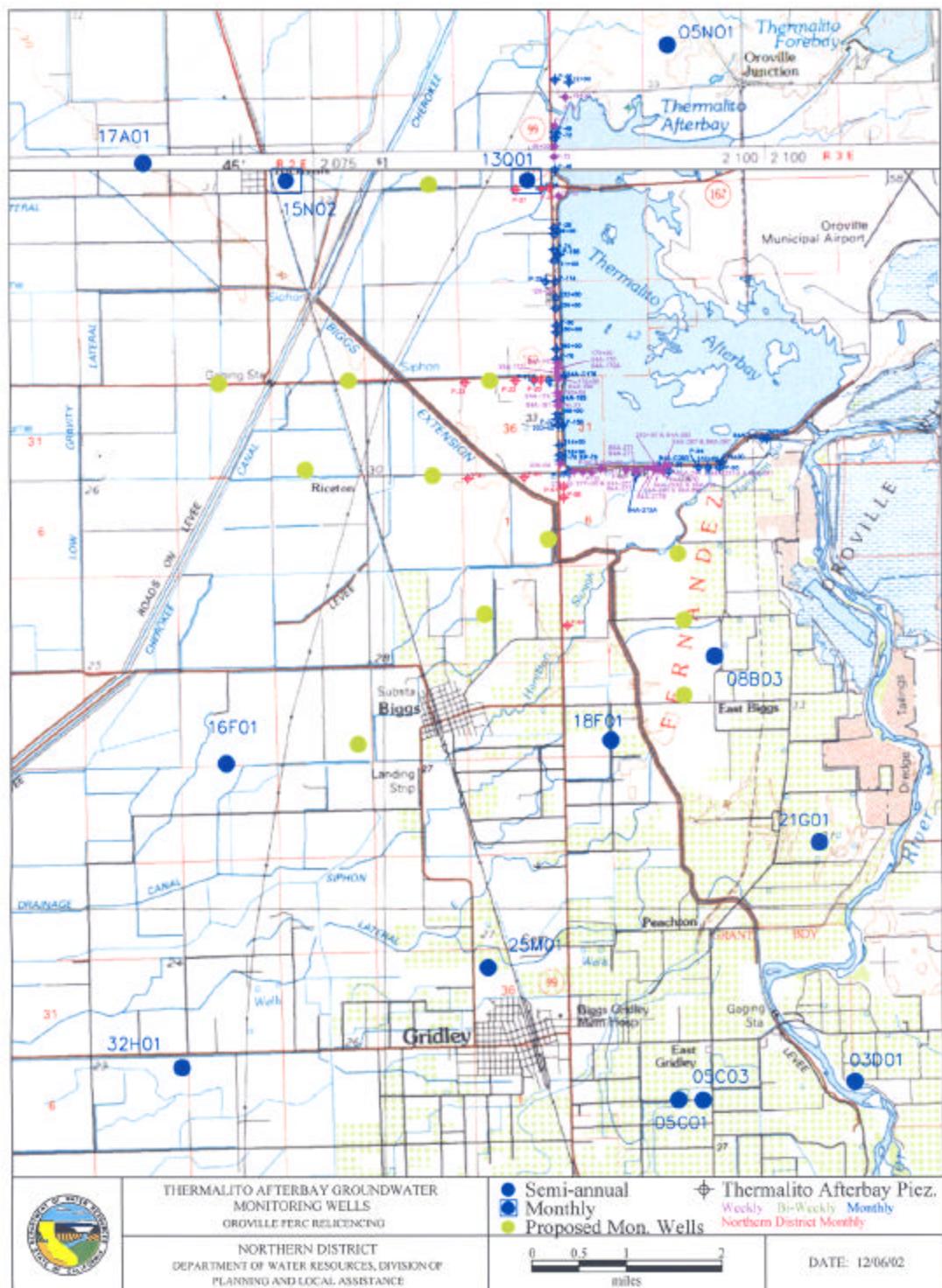


Figure 2. Current DWR groundwater level monitoring wells

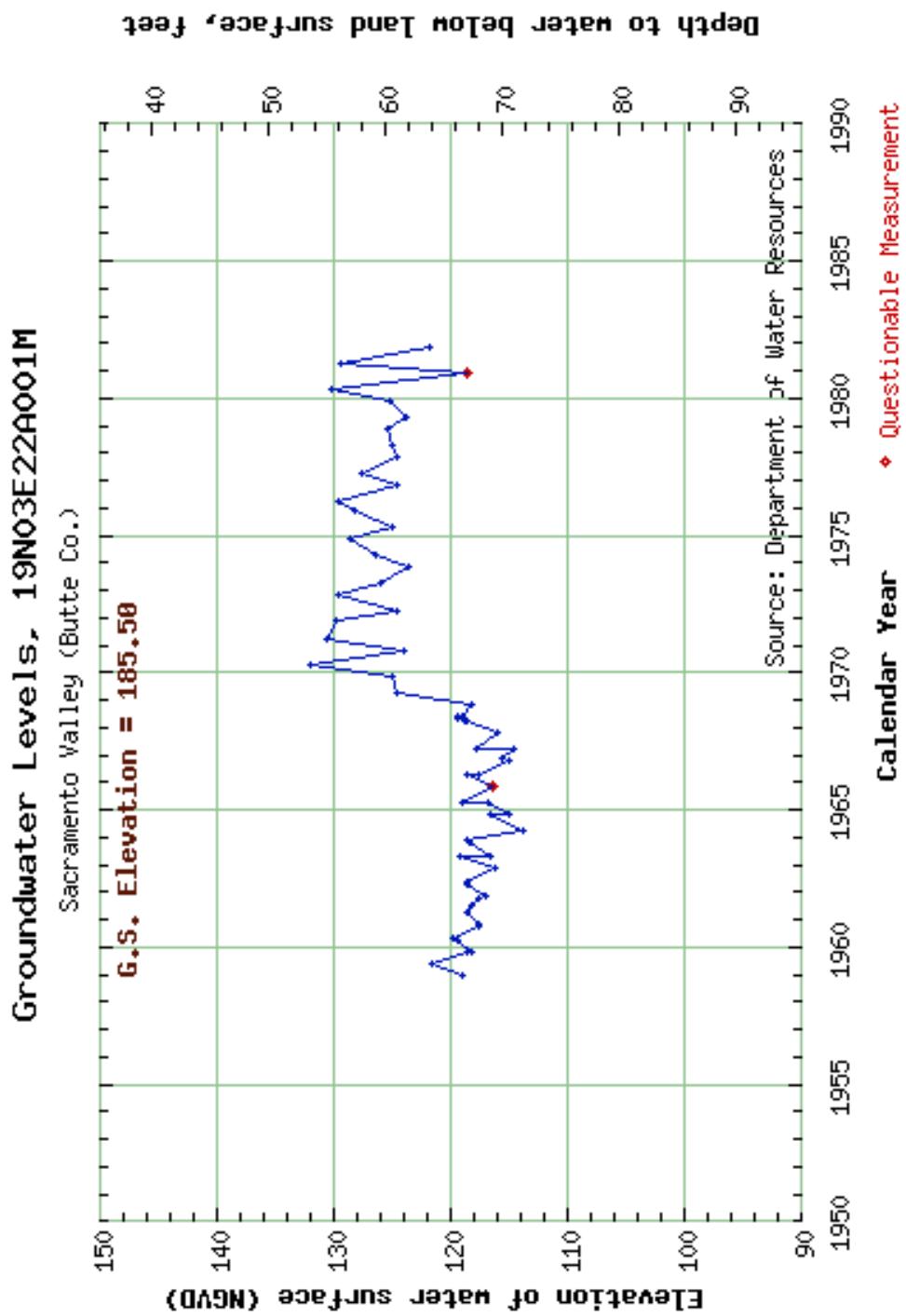


Figure 3. Groundwater levels in the vicinity of the Thermalito Forebay

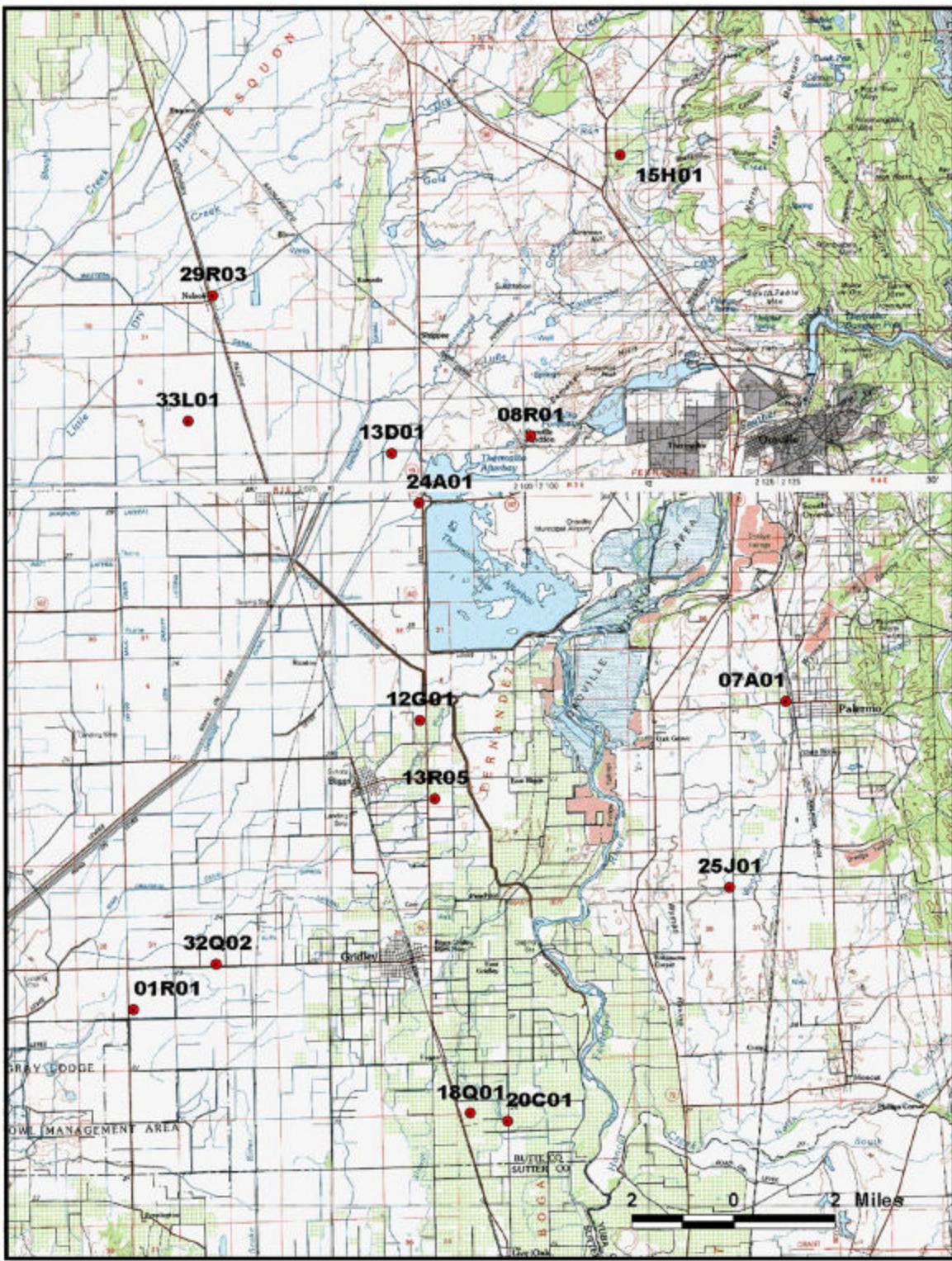


Figure 4. Groundwater quality monitoring wells in the vicinity of the Thermalito Forebay and Afterbay

Appendix 1  
Groundwater Physical Data

<u>Well Number</u>	<u>Date</u>	<u>Time</u> <u>(PST)</u>	Temp °C	Temp. °F	pH (field)	field EC (micromhos)	Coliform (# Colonies/100mL)
17N/01E-01R01	06/25/85	1415	20.0	68	7.3	1000	
17N/01E-01R01	07/29/86	0925	18.9	66	7.5	1200	
17N/01E-01R01	09/05/90	0950			7.3	1272	
17N/01E-01R01	10/03/91	0810			7.5	1036	
17N/03E-18Q01	01/30/57	N/A				430	
17N/03E-18Q01	09/05/58	N/A				422	
17N/03E-18Q01	08/28/59	N/A				433	
17N/03E-18Q01	08/04/60	N/A				287	
17N/03E-18Q01	07/16/63	N/A				639	
17N/03E-18Q01	?/?/64	N/A				630	
17N/03E-18Q01	08/03/65	N/A				703	
17N/03E-18Q01	06/27/68	N/A				737	
17N/03E-18Q01	06/24/71	N/A			7.4	620	
17N/03E-18Q01	06/13/73	N/A				658	
17N/03E-18Q01	05/20/74	N/A				568	
17N/03E-18Q01	06/22/79	N/A				549	
17N/03E-18Q01	06/11/80	N/A				611	
17N/03E-18Q01	06/28/84	N/A				702	
17N/03E-18Q01	07/29/86	N/A	18.9	66	7.3	840	
17N/03E-18Q01	07/29/86	N/A	18.9	66	7.3	840	
17N/03E-18Q01	09/05/90	0930			7.3	718	
17N/03E-18Q01	09/05/90	0930			7.3	718	
17N/03E-18Q01	10/03/91	0755			7.3	792	
17N/03E-18Q01	10/03/91	0755			7.3	792	
17N/03E-18Q01	09/27/96	1350				937	
17N/03E-18Q01	09/27/96	1350				937	
17N/03E-20C01	09/03/70	N/A				319	
17N/03E-20C01	08/21/72	N/A				400	
17N/03E-20C01	06/17/76	N/A				339	
17N/03E-20C01	06/08/78	N/A				428	
17N/03E-20C01	08/10/83	N/A				491	
17N/03E-20C01	07/29/86	1010	19.4	67	7.1	600	
17N/03E-20C01	07/29/86	1010	19.4	67	7.1	600	
17N/03E-20C01	09/05/90	0910			7.2	577	
17N/03E-20C01	09/05/90	0910			7.2	577	
17N/03E-20C01	10/03/91	0750			7.3	598	
17N/03E-20C01	10/03/91	0750			7.3	598	
18N/02E-12G01	01/30/57	N/A				217	
18N/02E-12G01	10/24/58	N/A				212	
18N/02E-12G01	08/05/59	N/A				212	
18N/02E-12G01	08/04/60	N/A				240	
18N/02E-12G01	07/16/63	N/A				285	
18N/02E-12G01	?/?/1964	N/A				222	
18N/02E-12G01	08/03/65	N/A				480	
18N/02E-12G01	06/27/68	N/A				218	
18N/02E-12G01	08/26/69	N/A			7.4	259	
18N/02E-12G01	06/24/71	N/A			7.7	278	
18N/02E-12G01	05/28/75	N/A				275	
18N/02E-12G01	06/17/76	N/A				292	
18N/02E-12G01	05/19/77	N/A				320	

Appendix 1  
Groundwater Physical Data

<u>Well Number</u>	<u>Date</u>	<u>Time (PST)</u>	<u>Temp °C</u>	<u>Temp. °F</u>	<u>pH</u>	<u>field EC (micromhos)</u>	<u>Coliform (# Colonies/100mL)</u>
18N/02E-12G01	06/14/82	N/A				297	
18N/02E-12G01	07/29/86	0820	17.2	63	6.8	445	
18N/02E-12G01	06/14/89	1330	17.2	63	6.7	365	
18N/02E-12G01	09/05/90	1020			7.0	318	
18N/02E-12G01	10/03/91	0900			6.9	292	
18N/02E-12G01	07/20/94	1230	18.8	65.8	6.4	272	
18N/02E-12G01	08/24/94	0910	18.8	65.8	6.3	258	
18N/02E-12G01	09/21/94	0930	20.5	68.9	6.3	267	
18N/02E-12G01	09/27/96	1410			6.2	271	
18N/02E-12G01	08/25/98	1250			6.5	323	
18N/02E-12G01	08/09/00	1140				279	
18N/02E-13R05	09/03/70	N/A				174	
18N/02E-13R05	06/17/76	N/A				181	
18N/02E-13R05	05/19/77	N/A				173	
18N/02E-13R05	06/25/85	1545	20.5	67	7.3	200	
18N/02E-13R05	06/25/85	1545	20.5	67	7.3	200	
18N/02E-13R05	09/05/90	1010			7.4	203	
18N/02E-13R05	09/05/90	1010			7.4	203	
18N/02E-13R05	10/03/91	0840			7.5	196	
18N/02E-13R05	10/03/91	0840			7.5	196	
18N/02E-32Q02	06/14/89	1040	20.5	67	7.8	226	
18N/02E-32Q02	07/20/94	1200	20.4	68.7	7.6	235	
18N/02E-32Q02	08/24/94	0830	19.2	66.6	7.6	240	
18N/02E-32Q02	09/21/94	0900	20.9	69.6	7.5	232	
18N/03E-25J01	09/07/88	0800	20.5	72	7.1	400	
18N/03E-25J01	09/05/90	0740			7.0	419	
18N/03E-25J01	10/02/91	1140			7.1	456	
18N/04E-07A01	09/07/88	0700	18.3	65	7.0	170	
18N/04E-07A01	09/05/90	0705			7.1	169	
18N/04E-07A01	10/02/91	1115			7.3	171	
18N/04E-07A01	10/13/98	1030			7.1	170	
18N/04E-07A01	08/10/00	0900				166	0
19N/02E-13D01	08/03/92	0920	17.9	64.2	7.3	382	
19N/02E-13D01	08/18/92	0940	17.9	64.2	7.3	382	
19N/02E-24A01	06/14/89	1515	20.5	69	7.2	448	
19N/03E-08R01	09/22/66	1140					
20N/02E-29R03	09/07/88	1220	21.1	70	7.6	650	
20N/02E-29R03	09/05/90	1115			7.4	663	
20N/02E-29R03	10/03/91	0920			7.5	842	
20N/02E-29R03	10/09/96	1000			7.6	726	
20N/02E-29R03	08/25/98	1330			7.4	831	
20N/02E-29R03	08/09/00	0830				1038	13
20N/03E-15H01	01/31/57	N/A				123	
20N/03E-15H01	09/09/58	N/A				137	
20N/03E-15H01	08/27/59	N/A				139	
20N/03E-15H01	08/04/60	N/A				140	
20N/03E-15H01	07/18/63	N/A				164	
20N/03E-15H01	07/10/64	N/A				154	
20N/03E-15H01	07/30/65	N/A				157	
20N/03E-15H01	06/26/68	N/A				169	

Appendix 1  
Groundwater Physical Data

<u>Well Number</u>	<u>Date</u>	<u>Time (PST)</u>	<u>Temp °C</u>	<u>Temp. °F</u>	<u>pH (field)</u>	<u>field EC (micromhos)</u>	<u>Coliform (# Colonies/100mL)</u>
20N/03E-15H01	08/16/72	N/A				181	
20N/03E-15H01	06/16/76	N/A				158	
20N/03E-15H01	05/18/77	N/A				160	
20N/03E-15H01	06/30/81	N/A				166	
20N/03E-15H01	06/24/85	1320	18.3	65	6.8	180	
20N/03E-15H01	06/24/85	1320	18.3	65	6.8	180	
20N/03E-15H01	09/04/90	1345			6.1	193	
20N/03E-15H01	09/04/90	1345			6.1	193	
20N/03E-15H01	07/20/94	1000	18.1	65	6.1	166	
20N/03E-15H01	07/20/94	1000	18.1	65	6.1	166	
20N/03E-15H01	08/23/94	1220	19.4	67	6.1	168	
20N/03E-15H01	08/23/94	1220	19.4	67	6.1	168	
20N/03E-15H01	09/21/94	0800	19.2	67	6.1	164	
20N/03E-15H01	09/21/94	0800	19.2	67	6.1	164	
20N/03E-15H01	09/27/96	0800			6.2	147	
20N/03E-15H01	09/27/96	0800			6.2	147	
20N/03E-15H01	10/13/98	1130			6.3	146	
20N/03E-15H01	10/13/98	1130			6.3	146	
20N/03E-33L01M	04/04/00	0830	21.0	69.8	7.3	222	

Appendix 2  
Groundwater Mineral Data

Well Number	Date	(PST)	Time	Diss. Ca	Diss. Mg	Diss. Na	Diss. K	Alkalinity	Diss. SO4	Diss. Cl	Diss. NO3	Total Diss.	Solids	Diss. Hardness	Diss. B	Diss. F	Diss. SiO2
				(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
17N/01E-01R01	06/25/85	1415		31	72				30					374			
17N/01E-01R01	07/29/86	0925		57	85	80	6.4	545	52	23	54	675		492	0.2		
17N/03E-18Q01	01/30/57	N/A		31	31	17	1.8	222	8.2	4.4	9.9			203	0.0	0.2	78
17N/03E-18Q01	09/05/58	N/A		28	28	18	0.7	211	7	5	4	324		185	0.1	0.2	28
17N/03E-18Q01	08/28/59	N/A		33	31	20	1	243	5.1	1	4			210	0.0	0.1	70
17N/03E-18Q01	08/04/60	N/A		20	20	12	1.3	148	2.8	2.4	2.1			131	0.0	0.1	53
17N/03E-18Q01	07/16/63	N/A		44	51	24	1	333	7.4	1.5	18	417		322	0.0		
17N/03E-18Q01	?/?/64	N/A		50	51	24	0.9	368	6	1.6	5.2	392		334	0.0		
17N/03E-18Q01	08/03/65	N/A		88	33	24	1	395	4.4	2.8	4.8	381		357	0.0		
17N/03E-18Q01	06/27/68	N/A		56		24		368		2.6		0		332			
17N/03E-18Q01	06/24/71	N/A		45	48	22	0.7	336	4	1.1	23	364		310	0.0		
17N/03E-18Q01	06/13/73	N/A								8.4	56			306	0.0		
17N/03E-18Q01	05/20/74	N/A		40	40	21	0.8	263	14	1.4	37	342		265	0.0		
17N/03E-18Q01	06/22/79	N/A		40	39			239		4	33			261			
17N/03E-18Q01	06/11/80	N/A		45	43	23	0.4	244		6	46			289			
17N/03E-18Q01	06/28/84	N/A		54	52	24		265		6	42			349			
17N/03E-18Q01	07/29/86	N/A		58	59	23	1.2	315	68	5	60	538		388	0.0		
17N/03E-18Q01	07/29/86	N/A		58	59	23	1.2	315	68	5	60	538		388	0.0		
17N/03E-18Q01	09/27/96	1350		81	69	23	1.3	273	58	28		562		486	<0.1		
17N/03E-18Q01	09/27/96	1350		81	69	23	1.3	273	58	28		562		486	<0.1		
17N/03E-20C01	09/03/70	N/A		21	22	12	0.9	138	11	2.1	20	227		144	0		
17N/03E-20C01	08/21/72	N/A		25	27	14	1	148	18	7.5	30	277		174	0		
17N/03E-20C01	06/17/76	N/A							4.6	24				154			
17N/03E-20C01	06/08/78	N/A		29	30	15	0.8	144	40	6.4	35	356		196	0		
17N/03E-20C01	08/10/83	N/A		33	35			173		5	47			227			
17N/03E-20C01	07/29/86	1010		39	43	16	1.3	194	59	9	51	410		275	0.0		
17N/03E-20C01	07/29/86	1010		39	43	16	1.3	194	59	9	51	410		275	0.0		
18N/02E-12G01	01/30/57	N/A		19	15	7.4	0.4	106	3.1	2.6	1.3			108	0.1	0.1	45
18N/02E-12G01	10/24/58	N/A		16	12	8	0.7	98	8	4	0	164		90	0.0	0	29
18N/02E-12G01	08/05/59	N/A		18	12	9	1.6	102	5	4	1.3			94	0.0	0	54
18N/02E-12G01	08/04/60	N/A		20	14	8.8	0.3	104	8.2	6.8	1.1			107	0.0	0	67
18N/02E-12G01	07/16/63	N/A		22	17	13	0.5	132	8.1	3.1	5.9	191		126	0.1		
18N/02E-12G01	?/?/64	N/A		18	13	11	0.2	108	7	2.1	1.2	155		98	0.0		
18N/02E-12G01	08/03/65	N/A		85	1.7	19	0.8	225	8.2	11	5	276		219	0.0		
18N/02E-12G01	06/27/68	N/A				11		103		2.6		0		87			
18N/02E-12G01	08/26/69	N/A		20	17	11	0	137	2.3	2.5	1	132		120	0.0		
18N/02E-12G01	06/24/71	N/A				11		144		3.6				125			
18N/02E-12G01	05/28/75	N/A				8.6		142		3				132			
18N/02E-12G01	06/17/76	N/A							6.6					141			

Appendix 2  
Groundwater Mineral Data

Well Number	Date	Time (PST)	Diss. Ca (mg/L)	Diss. Mg (mg/L)	Diss. Na (mg/L)	Diss. K (mg/L)	Alkalinity (mg/L)	Diss. SO4 (mg/L)	Diss. Cl (mg/L)	Diss. NO3 (mg/L)	Total Diss. (at 180 degree F) (mg/L)	Solids (as CaCO3 mg/L)	Diss. Hardness (mg/L)	Diss. B (mg/L)	Diss. F (mg/L)	Diss. SiO2 (mg/L)	
18N/02E-12G01	05/19/77	N/A	25	20	10	0.4	161	3	2	0	167	145	0.0				
18N/02E-12G01	06/14/82	N/A	24	19	10	0.5	144		3				138	0.0			
18N/02E-12G01	07/29/86	0820	33	26	20	0.7	180	17	11	21	277	190	0.0				
18N/02E-12G01	06/14/89	1330	24	20	12	0.5	150	14	8.9		220			<0.1	<0.05	22	
18N/02E-12G01	07/20/94	1230	19	17	14	0.4	116	10	4	11	187	118	<0.1				
18N/02E-12G01	08/24/94	0910	15	16	13	0.4	113	10	4	8.7	178	104	<0.1				
18N/02E-12G01	09/21/94	0930	19	16	13	0.4	120	8	3	7.6	184	114	<0.1				
18N/02E-12G01	09/27/96	1410	24	17	13	<0.5	122	8	4		174	130	<0.1				
18N/02E-12G01	08/09/00	1140	19	16	11	<0.5		11	7		196	113	<0.1				
18N/02E-13R05	09/03/70	N/A	11	10	10	0.6	89	0.6	2.4	0.2	148	71	0				
18N/02E-13R05	06/17/76	N/A						2.2				73					
18N/02E-13R05	05/19/77	N/A	11	9	12	0.5	87	2	1	0	76	65	0				
18N/02E-13R05	06/25/85	1545	12	12	11		97		1			80					
18N/02E-13R05	06/25/85	1545	12	12	11		97		1			80					
18N/02E-13R05	09/05/90	1010	7	6	20	0.7			1			42					
18N/02E-13R05	09/05/90	1010	7	6	20	0.7			1			42					
18N/02E-32Q02	06/14/89	1040	12	14	18	2.8	110	<1	4.2		140			<0.1	0.07	30	
18N/02E-32Q02	07/20/94	1200	13	16	15	2.4	114	2	5	2.8	177	98	<0.1				
18N/02E-32Q02	08/24/94	0830	11	15	15	2.5	116	4	4	2.7	177	89	<0.1				
18N/02E-32Q02	09/21/94	0900	13	14	14	2.4	113	2	4	2.8	173	90	<0.1				
18N/03E-25J01	09/07/88	0800	30	27	14	1.9	143	19	26	7.4	265	186	<0.1				
18N/04E-07A01	09/07/88	0700	14	8	11	0.9	69		3	8.2		68					
18N/04E-07A01	08/10/00	0900	13	7	11	0.73	68	6	3		141	61	<0.1				
19N/02E-13D01	08/03/92	0920	32	24	16	2.2	173	7	14	5.4	261	179	<0.1				
19N/02E-24A01	06/14/89	1515	36	26	22	2.3	230	14	2.3		290			<0.1	0.07	35	
19N/03E-08R01	09/22/66	1140						4			136						
20N/02E-29R03	09/07/88	1220	56	32	33	1.7	197		76	3.0		271					
20N/02E-29R03	10/09/96	1000	65	37	31	2.7	224	36	74		430	314	<0.1				
20N/02E-29R03	08/09/00	0830	85	46	54	1.96	330	60	94		672	402	<0.1				
20N/03E-15H01	01/31/57	N/A	11	6	3.7	2.0	56	3	0.6	0.2	98	52	0.02	0.3	38		
20N/03E-15H01	09/09/58	N/A	12	6	5	1.9	60	5	5	0	98	56	0	0	27		
20N/03E-15H01	08/27/59	N/A	13	7.9	4.7	2.2	66	2	6	0.2	108	66	0	0.1	31		
20N/03E-15H01	08/04/60	N/A	12	6.3	4.4	2.2	58	2.3	2.1	3.3	105	56	0.05	0.1	37		
20N/03E-15H01	07/18/63	N/A	14	9	5.1	2.4	76	2.6	1.3	0.5	103	72	0				
20N/03E-15H01	07/10/64	N/A	13	9.1	5.5	2.3	76	4	1.2	2.2	111	70	0				
20N/03E-15H01	07/30/65	N/A	21	3.8	4.2	2.1	74	2.5	2.4	0.4	108	68	0				
20N/03E-15H01	06/26/68	N/A			5.3				1.9		0	75					
20N/03E-15H01	08/16/72	N/A					67		2.3			78					
20N/03E-15H01	06/16/76	N/A							3			70					
20N/03E-15H01	05/18/77	N/A	14	8	7	1.4	73	5	2	3.8	91	68	0.1				

Appendix 2  
Groundwater Mineral Data

<u>Well Number</u>	<u>Date</u>	<u>Time</u>	Diss. Ca	Diss. Mg	Diss. Na	Diss. K	Alkalinity	Diss. SO4	Diss. Cl	Diss. NO3	Total Diss.	Solids	Diss. Hardness	Diss. B	Diss. F	Diss. SiO2
		(PST)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(at 180 degree F)	(as CaCO3 mg/L)	(mg/L)	(mg/L)	(mg/L)	
20N/03E-15H01	06/30/81	N/A	15	8	5	2.5	74		1				70			
20N/03E-15H01	06/24/85	1320	16	9	5		72		1	18			77			
20N/03E-15H01	06/24/85	1320	16	9	5		72		1	18			77			
20N/03E-15H01	09/04/90	1345	17	10	5	2.9	80	6	2	10	135		84	0.1		
20N/03E-15H01	09/04/90	1345	17	10	5	2.9	80	6	2	10	135		84	0.1		
20N/03E-15H01	07/20/94	1000	14	9	4	2.4	69	7	2	6.2	124		72	<0.1		
20N/03E-15H01	07/20/94	1000	14	9	4	2.4	69	7	2	6.2	124		72	<0.1		
20N/03E-15H01	08/23/94	1220	12	9	5	2.5	68	10	2	7.4	126		67	0.1		
20N/03E-15H01	08/23/94	1220	12	9	5	2.5	68	10	2	7.4	126		67	0.1		
20N/03E-15H01	09/21/94	0800	14	9	4	2.4	69	7	1	5.3	122		72	0.1		
20N/03E-15H01	09/21/94	0800	14	9	4	2.4	69	7	1	5.3	122		72	0.1		
20N/03E-15H01	09/27/96	0800	15	8	5	2.2	63	6	2		112		70	<0.1		
20N/03E-15H01	09/27/96	0800	15	8	5	2.2	63	6	2		112		70	<0.1		
20N/03E 33L01M	04/04/00	0830	14	9	11	2.04	90	1	3		164		72	<0.1		

Appendix 3  
Groundwater Nutrient Data

<u>Well Number</u>	<u>Date</u>	<u>Time</u> <u>(PST)</u>	Total NH <sub>3</sub> +Org N (mg/L)	Diss. NO <sub>2</sub> +NO <sub>3</sub> (mg/L as N)	Diss. NO <sub>2</sub> (mg/L as N)	Diss. NO <sub>3</sub> (mg/L as N)	Diss. NH <sub>3</sub> (mg/L as N)	Diss. Ortho-P0 <sub>4</sub> (mg/L)	Total P (mg/L)	
17N/03E-18Q01	09/27/96	1350	<0.1	33		<0.003	3.3	<0.01	0.06	0.31
18N/02E-12G01	06/14/89	1330			2.4		0.05	0.02	0.02	
18N/02E-12G01	09/27/96	1410			3		<0.01	<0.01	0.02	
18N/02E-12G01	08/09/00	1140					<0.01	<0.01	0.03	
18N/02E-32Q02	06/14/89	1040	<0.1			<0.003	0.68	<0.05	0.08	0.06
18N/04E-07A01	08/10/00	0900			1.8			<0.01	0.1	0.12
20N/02E-29R03	10/09/96	1000			0.65			<0.01	0.02	0.07
20N/02E-29R03	08/08/00	0830			0.91			<0.01	<0.01	0.09
20N/03E-15H01	09/27/96	0800			0.99			<0.01	0.04	0.09
20N/03E-33L01M	04/04/00	0830			0.05			0.06	<0.01	1

Appendix 4  
Groundwater Minor Element Data

<u>Well Number</u>	<u>Date</u>	<u>Time</u>	<u>Al</u>	<u>As</u>	<u>Ba</u>	<u>Cd</u>	<u>Cr</u>	<u>Cu</u>	<u>Fe</u>	<u>Pb</u>	<u>Mn</u>	<u>Hg</u>	<u>Ni</u>	<u>Se</u>	<u>Zn</u>	<u>Ag</u>
			(PST)	Form	(mg/L)											
17N/03E-18Q01	09/27/96	1350	Total		0.004	0.102	<0.005	0.007	0.008	0.030	<0.005	<0.005		<0.001	0.427	
18N/02E-12G01	06/14/89	1330	Total		<0.01	0.06	<0.005	<0.01	0.01	0.06	<0.003	<0.01	<0.0002	<0.01	0.01	
18N/02E-12G01	09/27/96	1410	Total		<0.001	0.068	<0.005	<0.005	0.013	0.034	<0.005	<0.005		<0.001	0.056	
18N/02E-12G01	08/09/00	1140	Total	0.012	<0.001		<0.001	<0.005	0.004	0.037	<0.001	<0.005	<0.0002	0.003	<0.001	<0.005 <0.001
18N/02E-32Q02	06/14/89	1040	Total		<0.01	0.03	<0.005	0.02	<0.01	<0.02	<0.003	<0.01	<0.0002	<0.01	0.02	
18N/04E-07A01	08/10/00	0900	Total	<0.01	<0.001		<0.001	<0.005	<0.001	0.101	<0.001	0.005	<0.0002	<0.001	<0.001	0.035 0.001
19N/02E-13D01	08/03/92	0920	Total		0.004		<0.005	0.005					<0.001		<0.001	
20N/02E-29R03	08/08/00	0830	Total	<0.01	0.005		<0.001	<0.005	0.002	<0.005	<0.001	<0.005	<0.0002	0.002	0.002	0.034 <0.001
20N/02E-29R03	10/09/96	1000	Total		0.005	0.110	<0.005	<0.005	<0.005	0.019	<0.005	<0.005			0.001	0.072
20N/03E-15H01	09/27/96	0800	Total		<0.001	0.106	<0.005	<0.005	0.011	0.067	<0.005	<0.005			<0.001	0.015
20N/03E-33L01M	04/04/00	0830	Total	1.3	0.00171	0.112	0.000015	0.00038	0.00595	7.72	0.000643	0.313	0.0000032	0.00213	<0.00014	0.00656

Appendix 5  
Groundwater Well Data

<u>Well</u>	<u>Identifier</u>	<u>Northing</u>	<u>Easting</u>	<u>Depth</u>	<u>Use</u>	<u>'erforatio</u>	<u>Casing</u>	<u>Size (in)</u>	<u>Cased</u>
17N-01E-01R01	01R01	4356384.857	603694.672	126	D			8	90
17N-03E-18Q01	18Q01	4353114.934	614312.624	32	D&I			6	
17N-03E-20C01	20C01	4352857.921	615490.521	40	D			8	40
18N-02E-12G01	12G01	4365526.319	612725.479	108	D&S			6	
18N-02E-13R05	13R05	4363056.825	613193.531	60	D			8	52
18N-02E-32Q02	32Q02	4357840.146	606309.823	110	D	14?	8 at pump base		
18N-03E-25J01	25J01	4360261.64	622493.329	75	D			8	40
18N-04E-07A01	07A01	4366141.287	624272.939	72.0	D			8	
19N-02E-13D01	13D01	4373961.032	611824.116	118	I	56-80		14	80
19N-02E-24A01	24A01	4372390.548	612697.373	40?	D				
19N-03E-08R01	08R01	4374507.117	616222.144	40	S				
20N-02E-29R03	29R03	4378962.697	606201.244	108	D			8	40
20N-03E-15H01	15H01	4383402.74	619041.731	85	D			8	
20N-03E-33L01M	33L01	4374996.6	605414.054	~101	I				

Well Use

D=Domestic  
I=Irrigation  
S=Stock

Appendix 6  
Surface Physical Data

<u>Station Name</u>	<u>Date</u>	<u>Time</u>	<u>Depth</u> <u>(meters)</u>	<u>Temp.</u> <u>°C</u>	<u>Temp.</u> <u>°F</u>	<u>D.O.</u> <u>(ppm)</u>	<u>pH</u>	<u>EC(field)</u> <u>(micromhos)</u>	<u>Alkalinity</u> <u>(mg/L)</u>
North Forebay	04/02/02	1215	0	12.4	54.3	10.7	7.5	90	43
North Forebay	04/02/02	1215	7.2	11.3	52.3	10.5	7.4	89	42
North Forebay	04/29/02	0845	0	10.2	50.4	10.3	7.7	91	43
North Forebay	04/29/02	0845	5.5	10.0	50.0	9.9	7.6	90	42
North Forebay	05/22/02	1030	0	11.8	53.2	11.5	7.3	69	42
North Forebay	05/22/02	1030	8	10.9	51.6	10.2	7.3	65	41
North Forebay	06/17/02	1145	0	15.0	59.0	9.5	7.5	86	39
North Forebay	06/17/02	1145	5	14.9	58.8	10.0	7.4	84	40
North Forebay	07/18/02	1300	0	14.5	58.1	9.1	7.2	90	42
North Forebay	07/18/02	1300	6	13.9	57.0	9.0	7.2	93	42
North Forebay	08/19/02	1100	0	13.9	57.0	8.9	7.2	85	41
North Forebay	08/19/02	1100	6	13.6	56.5	9.5	7.1	88	40
North Forebay	09/17/02	0800	0	11.8	53.2	8.5	7.2	93	40
North Forebay	09/17/02	0800	3.5	10.6	51.1	8.4	7.2	91	
North Forebay	10/22/02	0950	0	12.7	54.9	9.9	7.3	90	44
North Forebay	10/22/02	0950	8	12.6	54.7	9.6	7.3	90	45
North Forebay	11/19/02	1300	0	13.1	55.6	10.2	7.4	91	
North Forebay	11/19/02	1300	8	12.2	54.0	10.1	7.4	91	
North Forebay	12/20/02	1320	0	11.6	52.9	10.1	7.6	94	
North Forebay	12/20/02	1320	8	11.5	52.7	9.4	7.5	94	
South Forebay	04/02/02	1415	0	16.3	61.4	9.8	8.1	90	42
South Forebay	04/02/02	1415	9	12.4	54.2	10.9	7.8	90	42
South Forebay	04/29/02	0730	0	10.9	51.6	9.6	7.2	91	
South Forebay	04/29/02	0730	7	10.6	51.1	9.6	7.2	91	
South Forebay	05/22/02	0900	0	12.0	53.6	11.4	7.3	65	41
South Forebay	05/22/02	0900	9	10.9	51.6	11.0	7.3	65	40
South Forebay	06/17/02	1035	0	16.2	61.2	9.5	7.4	85	40
South Forebay	06/17/02	1035	9	15.3	59.5	9.2	7.4	86	39
South Forebay	07/18/02	1130	0	14.7	58.5	9.3	7.2	91	41
South Forebay	07/18/02	1130	11	13.5	56.3	9.2	7.2	90	
South Forebay	08/19/02	1300	0	15.3	59.5	8.9	7.3	88	41
South Forebay	08/19/02	1300	7.5	14.4	57.9	8.6	7.0	89	42
South Forebay	09/17/02	1000	0	12.2	54.0	9.0	7.2	89	40
South Forebay	09/17/02	1000	6	10.5	50.9	8.5	7.3	91	
South Forebay	10/22/02	0840	0	13.7	56.7	9.8	7.5	89	44
South Forebay	10/22/02	0840	10	12.8	55.0	9.4	7.3	90	45
South Forebay	11/19/02	1400	0	12.7	54.9	10.2	7.5		
South Forebay	11/19/02	1400	9	12.1	53.8	10.0	7.4		
South Forebay	12/12/02	1215	0	11.9	53.4	10.0	7.7		
South Forebay	12/12/02	1215	9	11.5	52.7	9.1	7.6		
North Afterbay	04/02/02	1635	0	17.6	63.7	10.2			45
North Afterbay	04/02/02	1635	4.5			11.2	7.9	90	44
North Afterbay	04/24/02	0800	0	14.4	57.9	11.0	8.0	89	41
North Afterbay	04/24/02	0800	3.5	13.5	56.3	11.4	7.8	90	42
North Afterbay	05/23/02	0930	0	12.7	54.9	10.4	7.5	84	41
North Afterbay	05/23/02	0930	4	12.6	54.7	10.7	7.4	84	39
North Afterbay	06/17/02	0900	0	16.3	61.3	9.5	7.4	86	40
North Afterbay	06/17/02	0900	2.75	16.2	61.2	9.9	7.4	87	40

Appendix 6  
Surface Physical Data

<u>Station Name</u>	<u>Date</u>	<u>Time</u> <u>(PST)</u>	<u>Depth</u> <u>(meters)</u>	<u>Temp.</u> <u>°C</u>	<u>Temp.</u> <u>°F</u>	<u>D.O.</u> <u>(ppm)</u>	<u>pH</u>	<u>EC(field)</u> <u>(micromhos)</u>	<u>Alkalinity</u> <u>(mg/L)</u>
North Afterbay	07/18/02	0930	0	13.8	56.8	9.0	7.2	90	41
North Afterbay	07/18/02	0930	5	13.7	56.7	8.9	7.2	90	41
North Afterbay	08/19/02	0830	0	15.5	59.9	8.9	7.3	89	42
North Afterbay	08/19/02	0830	3.5	15.2	59.4	6.4	7.3	89	41
North Afterbay	09/17/02	1200	0	17.2	63.0	10.0	7.6	91	42
North Afterbay	09/17/02	1200	4	11.7	53.1	9.7	7.2	92	
North Afterbay	10/22/02	1130	0	14.0	57.2	9.5	7.3	90	45
North Afterbay	10/22/02	1130	3.5	13.1	55.6	9.9	7.4	90	45
North Afterbay	11/19/02	1125	0	12.5	54.5	10.0	7.5	91	
North Afterbay	11/19/02	1125	4	12.0	53.6	9.7	7.5	91	
North Afterbay	12/12/02	1015	0	11.7	53.1	10.0	7.7	94	
North Afterbay	12/12/02	1015	4	11.6	52.9	9.9	7.7	94	
South Afterbay	04/02/02	1745	0	19.9	67.8	7.6	8.1	91	43
South Afterbay	04/02/02	1745	5	13.9	57.0	9.8	7.6	91	44
South Afterbay	04/24/02	0930	0	15.7	60.3	10.3	7.9	91	43
South Afterbay	04/24/02	0930	4.5	15.3	59.5	10.5	7.9	90	43
South Afterbay	05/23/02	0830	0	13.3	55.9	10.7	7.5	84	40
South Afterbay	05/23/02	0830	5	13.1	55.6	10.1	7.4	84	41
South Afterbay	06/17/02	0815	0	16.5	61.7	9.0	7.4	85	35
South Afterbay	06/17/02	0815	3	16.4	61.5	9.0	7.4	86	39
South Afterbay	07/18/02	0800	0	14.2	57.6	9.8	7.3	90	40
South Afterbay	07/18/02	0800	6	14.0	57.2	9.6	7.2	90	41
South Afterbay	08/19/02	0915	0	16.1	61.0	9.1	7.3	87	41
South Afterbay	08/19/02	0915	4.5	15.1	59.2	8.2	7.3	89	41
South Afterbay	09/17/02	1315	0	14.9	58.8	9.5	7.3	89	41
South Afterbay	09/17/02	1315	4.5	12.3	54.1	9.2	7.2	92	
South Afterbay	10/22/02	1215	0	14.3	57.7	9.6	7.4	90	45
South Afterbay	10/22/02	1215	4	13.5	56.3	9.9	7.4	90	45
South Afterbay	11/19/02	1025	0	12.3	54.1	9.9	7.6	92	
South Afterbay	11/19/02	1025	3	12.1	53.8	9.9	7.6	92	
South Afterbay	12/12/02	0900	0	11.6	52.9	10.1	7.8	93	
South Afterbay	12/12/02	0900	5	11.6	52.9	9.9	7.8	93	

Appendix 7  
Surface Mineral Data

Station Name	Date	Time (PST)	Diss. B (mg/L)	Diss. Ca (mg/L)	Diss. Cl (mg/L)	Diss. Mg (mg/L)	Diss. K (mg/L)	Diss. Na (mg/L)	Diss. SO4 (mg/L)	Diss. Hardness (mg/L as CaCO <sub>3</sub> )	Total Hardness (mg/L as CaCO <sub>3</sub> )	Total Ca (mg/L)	Total Mg (mg/L)
N Forebay Sfc	05/22/02	1030	<0.1	8	<1	4	0.8	3	2	36	39	9	4
N Forebay Btm	05/22/02	1030	<0.1	8	<1	4	0.7	3	2	36	36	8	4
N Forebay Sfc	06/17/02	1145	<0.1	8	<1	4	0.7	3	2	36	36	8	4
N Forebay Btm	06/17/02	1145	<0.1	8	<1	4	0.7	3	2	36	36	8	4
N Forebay Sfc	07/18/02	1300	<0.1	9	<1	4	0.8	3	2	39	39	9	4
N Forebay Btm	07/18/02	1300	<0.1	9	<1	4	0.9	4	2	39	39	9	4
N Forebay Sfc	08/19/02	1100	<0.1	8	1	4	0.7	3	2	36	36	8	4
N Forebay Btm	08/19/02	1100	<0.1	9	1	4	0.8	4	2	39	39	9	4
N Forebay Sfc	09/17/02	0800	<0.1	9	1	4	0.8	4	2	39	39	9	4
N Forebay Btm	09/17/02	0800	<0.1	8	1	4	0.7	3	2	36	39	9	4
N Forebay Sfc	10/22/02	0930	<0.1	8	1	4	0.9	4	2	36	36	8	4
N Forebay Btm	10/22/02	0950	<0.1	9	1	4	0.9	4	2	39	39	9	4
S Forebay Sfc	05/22/02	0900	<0.1	8	<1	4	0.7	3	2	36	36	8	4
S Forebay Btm	05/22/02	0900	<0.1	9	<1	4	0.8	4	2	39	39	9	4
S Forebay Sfc	06/17/02	1035	<0.1	8	<1	4	0.8	3	2	36	36	8	4
S Forebay Btm	06/17/02	1035	<0.1	8	<1	4	0.7	3	2	36	39	9	4
S Forebay Sfc	07/18/02	1130	<0.1	9	<1	4	0.8	3	2	39	39	9	4
S Forebay Btm	07/18/02	1130	<0.1	9	<1	4	0.8	4	2	39	39	9	4
S Forebay Sfc	08/19/02	1300	<0.1	8	1	4	0.8	3	2	36	36	8	4
S Forebay Btm	08/19/02	1300	<0.1	9	1	4	0.9	4	2	39	41	10	4
S Forebay Sfc	09/17/02	1000	<0.1	8	1	4	0.7	4	2	36	39	9	4
S Forebay Btm	09/17/02	1000	<0.1	8	1	4	0.7	3	2	36	36	8	4
S Forebay Sfc	10/22/02	0840	<0.1	8	1	4	0.9	4	2	36	36	8	4
S Forebay Btm	10/22/02	0840	<0.1	9	1	4	0.9	4	2	39	39	9	4
N Afterbay Sfc	05/23/02	0930	<0.1	8	<1	4	0.7	3	2	36	36	8	4
N Afterbay Btm	05/23/02	0930	<0.1	8	<1	4	0.8	3	2	36	36	8	4
N Afterbay Sfc	06/17/02	0900	<0.1	8	<1	4	0.7	3	2	36	39	9	4
N Afterbay Btm	06/17/02	0900	<0.1	8	<1	4	0.7	3	2	36	36	8	4
N Afterbay Sfc	07/18/02	0930	<0.1	9	<1	4	0.8	3	2	39	39	9	4
N Afterbay Btm	07/18/02	0930	<0.1	9	<1	4	0.9	3	2	39	39	9	4
N Afterbay Sfc	08/19/02	0830	<0.1	10	1	4	0.9	4	2	41	41	10	4
N Afterbay Btm	08/19/02	0830	<0.1	10	1	4	0.9	4	2	41	41	10	4
N Afterbay Sfc	09/17/02	1200	<0.1	8	1	4	0.7	4	2	36	39	9	4

Appendix 7  
Surface Mineral Data

<u>Station Name</u>	<u>Date</u>	<u>Time (PST)</u>	Diss. B <u>(mg/L)</u>	Diss. Ca <u>(mg/L)</u>	Diss. Cl <u>(mg/L)</u>	Diss. Mg <u>(mg/L)</u>	Diss. K <u>(mg/L)</u>	Diss. Na <u>(mg/L)</u>	Diss. SO4 <u>(mg/L)</u>	Diss. Hardness <u>(mg/L as CaCO3 )</u>	Total Hardness <u>(mg/L as CaCO3 )</u>	Total Ca <u>(mg/L)</u>	Total Mg <u>(mg/L)</u>
N Afterbay Btm	09/17/02	1200	<0.1	8	1	4	0.7	4	2	36	36	8	4
N Afterbay Sfc	10/22/02	1130	<0.1	9	1	4	1	4	2	39	39	9	4
N Afterbay Btm	10/22/02	1130	<0.1	9	1	4	0.9	4	2	39	39	9	4
S Afterbay Sfc	05/23/02	0830	<0.1	8	<1	4	0.7	3	2	36	36	8	4
S Afterbay Btm	05/23/02	0830	<0.1	8	<1	4	0.7	3	2	36	36	8	4
S Afterbay Sfc	06/17/02	0815	<0.1	8	<1	4	0.7	3	2	36	36	8	4
S Afterbay Btm	06/17/02	0815	<0.1	8	<1	3	0.7	3	2	32	39	9	4
S Afterbay Sfc	07/18/02	0800	<0.1	9	<1	4	0.8	3	2	39	39	9	4
S Afterbay Btm	07/18/02	0800	<0.1	9	<1	4	0.8	4	2	39	39	9	4
S Afterbay Sfc	08/19/02	0915	<0.1	8	1	4	0.7	3	2	36	36	8	4
S Afterbay Btm	08/19/02	0915	<0.1	10	1	4	0.9	4	2	41	32	8	3
S Afterbay Sfc	09/17/02	1315	<0.1	9	1	4	0.8	4	2	39	39	9	4
S Afterbay Btm	09/17/02	1315	<0.1	8	1	4	0.7	3	2	36	36	8	4
S Afterbay Sfc	10/22/02	1245	<0.1	9	1	4	0.9	4	2	39	39	9	4
S Afterbay Btm	10/22/02	1200	<0.1	9	1	4	0.9	4	2	39	39	9	4

Appendix 8  
Surface Nutrient Data

<u>Station Name</u>	<u>Date</u>	<u>Time (PST)</u>	Diss. NO <sub>3</sub> + NO <sub>2</sub> <u>(mg/L)</u>	Diss. NH <sub>3</sub> <u>(mg/L)</u>	Total NH <sub>3</sub> <u>(mg/L)</u>	Diss. Ortho-PO <sub>4</sub> <u>(mg/L)</u>	Total P <u>(mg/L)</u>	Diss Organic Carbon <u>(mg/L)</u>	Total Organic Carbon <u>(mg/L)</u>
N Forebay Sfc	05/22/02	1030	0.2		<0.01	0.06	1.1		1.4
N Forebay Btm	05/22/02	1030	0.2		<0.01	0.4	1		1.9
N Forebay Sfc	06/17/02	1145	0.02	<0.01		<0.01	0.01	1.1	1.2
N Forebay Btm	06/17/02	1145	0.02	<0.01		<0.01	<0.01	1.1	1.4
N Forebay Sfc	07/18/02	1300	0.03	<0.01		0.01	<0.01	1.2	1.2
N Forebay Btm	07/18/02	1300	0.03	<0.01		<0.01	<0.01	1.2	1.6
N Forebay Sfc	08/19/02	1100	0.03	<0.01		<0.01	0.01	1.4	1.1
N Forebay Btm	08/19/02	1100	0.03	<0.01		0.01	<0.01	1.4	1.1
N Forebay Sfc	09/17/02	0800	0.06	<0.01	ND	<0.01	0.01	1.2	1.3
N Forebay Btm	09/17/02	0800	0.06	<0.01	ND	<0.01	0.01	1.3	1.2
N Forebay Sfc	10/22/02	0930	0.05	<0.01		0.01	0.01	2	1.4
N Forebay Btm	10/22/02	0950	0.05	<0.01		<0.01	0.01		1.4
N Forebay Sfc	11/19/02	1300			ND				
N Forebay Btm	11/19/02	1300			ND				
S Forebay Sfc	05/22/02	0900	0.2			<0.01	0.06	1.2	1.4
S Forebay Btm	05/22/02	0900	0.2			<0.01	0.08	1.1	1.4
S Forebay Sfc	06/17/02	1035	0.01	<0.01		<0.01	0.01	1.2	1.5
S Forebay Btm	06/17/02	1035	0.01	<0.01		<0.01		1.1	1.4
S Forebay Sfc	07/18/02	1130	0.03	<0.01		<0.01	<0.01	1.2	1.3
S Forebay Btm	07/18/02	1130	0.03	<0.01		<0.01	<0.01	1	1.4
S Forebay Sfc	08/19/02	1300	0.02	<0.01		0.01	<0.01	1.6	1.2
S Forebay Btm	08/19/02	1300	0.02	<0.01		<0.01	<0.01	1.4	1.2
S Forebay Sfc	09/17/02	1000	0.65	<0.01	ND	0.01	<0.01	1.6	1.4
S Forebay Btm	09/17/02	1000	0.17		ND	<0.01	0.01	1.2	1.2
S Forebay Sfc	10/22/02	0840	0.03	<0.01		<0.01	<0.01	1.6	1.3
S Forebay Btm	10/22/02	0840	0.04	<0.01	ND	<0.01	0.01	1.3	1.5
S Forebay Sfc	11/19/02	1400			ND				
S Forebay Btm	11/19/02	1400			ND				
N Afterbay Sfc	05/23/02	0930	0.03	<0.01		<0.01	0.02	1.1	1.7
N Afterbay Btm	05/23/02	0930	0.02	<0.01		<0.01	0.01	1.1	1.6
N Afterbay Sfc	06/17/02	0900	0.01	<0.01		<0.01	0.01	1.2	1.3
N Afterbay Btm	06/17/02	0900	<0.01	<0.01		<0.01	<0.01	1.1	1.3
N Afterbay Sfc	07/18/02	0930	0.03	<0.01		<0.01		1.1	1.3

Appendix 8  
Surface Nutrient Data

<u>Station Name</u>	<u>Date</u>	<u>Time</u> <u>(PST)</u>	Diss. NO <sub>3</sub> + NO <sub>2</sub> <u>(mg/L)</u>	Diss. NH <sub>3</sub> <u>(mg/L)</u>	Total NH <sub>3</sub> <u>(mg/L)</u>	Diss. Ortho-PO <sub>4</sub> <u>(mg/L)</u>	Total P <u>(mg/L)</u>	Diss Organic Carbon <u>(mg/L)</u>	Total Organic Carbon <u>(mg/L)</u>
N Afterbay Btm	07/18/02	0930	0.04	<0.01		<0.01	0.35	1.2	1.7
N Afterbay Sfc	08/19/02	0830	0.02	<0.01		<0.01	<0.01	1.4	1.3
N Afterbay Btm	08/19/02	0830	0.02	<0.01		0.02	0.12	1.4	1.3
N Afterbay Sfc	09/17/02	1200	0.03	<0.01	ND	<0.01	<0.01	2	1.5
N Afterbay Btm	09/17/02	1200	0.48	<0.01	ND	<0.01	<0.01	2.2	1.3
N Afterbay Sfc	10/22/02	1130	0.04	<0.01	ND	<0.01	<0.01	1.9	1.9
N Afterbay Btm	10/22/02	1130	0.03	<0.01	ND	<0.01	0.01	1.4	1.6
N Afterbay Sfc	11/19/02	1300			ND				
N Afterbay Btm	11/19/02	1300			ND				
S Afterbay Sfc	05/23/02	0830				<0.01		1	1.6
S Afterbay Btm	05/23/02	0830	0.02	<0.01		<0.01	0.01	1	1.4
S Afterbay Sfc	06/17/02	0815	<0.01	<0.01		<0.01	0.01	1.2	1.5
S Afterbay Btm	06/17/02	0815	<0.01	<0.01		<0.01	<0.01	1.2	1.6
S Afterbay Sfc	07/18/02	0800	0.03	<0.01		<0.01	0.01	1.2	1.4
S Afterbay Btm	07/18/02	0800	0.03	<0.01		<0.01	<0.01	1.2	1.3
S Afterbay Sfc	08/19/02	0915	0.02	<0.01		<0.01	<0.01	1.4	1.2
S Afterbay Btm	08/19/02	0915	0.02	<0.01		0.09	0.01	1.4	1.4
S Afterbay Sfc	09/17/02	1315	3.4	<0.01	ND	<0.01	<0.01	1.7	1.4
S Afterbay Btm	09/17/02	1315	0.03	0.01	ND	<0.01	0.01	2.2	1.5
S Afterbay Sfc	10/22/02	1245	0.02	<0.01	ND	<0.01	<0.01	1.8	1.3
S Afterbay Btm	10/22/02	1200	0.02	<0.01	ND	<0.01	<0.01	1.5	1.7
S Afterbay Sfc	11/19/02	1025			ND				
S Afterbay Btm	11/19/02	1025			ND				

ND=Not Detected

Appendix 9  
Surface Total Minor Element Data

		Time	Total Al	Total As	Total Cd	Total Cr	Total Cu	Total Fe	Total Hg	Total MeHg	Total Mn	Total Ni	Total Pb	Total Se	Total Zn
Station Name	Date	(PST)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
N Forebay Sfc	04/02/02	1215	0.0339	0.00036	<0.000003	0.00014	0.00067	0.0457	0.00000049	0.00000011	0.00348	0.00056	0.000014	<0.00009	0.00015
N Forebay Btm	04/02/02	1215	0.0411	0.000354	0.000003	0.00015	0.00102	0.0565	0.00000061	0.00000011	0.00347	0.0006	0.000021	<0.00009	0.00021
N Forebay Sfc	04/29/02	0845	0.0367	0.000368	0.000002	0.00035	0.00098	0.0447	0.00000059	0.00000005	0.00313	0.00093	0.000008	0.00013	0.00014
N Forebay Btm	04/29/02	0845	0.104	0.000475	0.000004	0.00048	0.00205	0.171	0.00000118	<0.00000005	0.0062	0.00117	0.000732	<0.00012	0.00035
N Forebay Sfc	05/22/02	1030	0.0255	0.000383	0.000003	0.00012	0.0008	0.0453	0.00000044	<0.00000009	0.00383	0.00068	0.00001	<0.00007	0.00012
N Forebay Btm	05/22/02	1030	0.0324	0.000385	0.000004	0.00015	1.33	0.204	0.00000063	0.00000024	0.00438	0.00129	0.000096	<0.00007	0.00025
N Forebay Sfc	08/19/02	1100	0.0374	0.000442	<0.000008	0.00022	0.00074	0.0545	N/A	<0.00000025	0.00412	0.00064	<0.000015	<0.00030	0.00014
N Forebay Btm	08/19/02	1100	0.0329	0.000625	<0.000008	0.00021	0.00317	0.0528	0.00000036	<0.00000025	0.00382	0.00067	<0.000015	<0.00030	0.00016
N Forebay Sfc	09/17/02	0800	0.0305	0.000349	<0.000008	<0.00007	0.00065	0.0491	0.00000034	<0.00000025	0.00398	0.00053	<0.000015	<0.00030	0.00014
N Forebay Btm	09/17/02	0800	0.0388	0.00038	<0.000008	0.00005	0.057	0.0629	0.00000039	<0.00000025	0.00428	0.00058	0.00006	<0.00030	0.00028
N Forebay Sfc	10/22/02	0950	0.0477	0.000574	<0.000008	0.00014	0.0006	0.076	<0.00000015	<0.00000025	0.00951	0.0005	<0.000015	<0.00030	0.00017
N Forebay Btm	10/22/02	0950	0.0533	0.000573	<0.000008	0.00018	0.00071	0.0817	0.00000026	<0.00000025	0.01	0.00052	<0.000015	<0.00030	0.00024
S Forebay Sfc	04/02/02	1415	0.0414	0.000346	<0.000003	0.00015	0.00071	0.0565	0.00000052	0.00000008	0.00298	0.00058	0.000019	<0.00009	0.00018
S Forebay Btm	04/02/02	1415	0.0466	0.000337	0.000946	0.00018	0.00082	0.0609	0.00000097	0.00000029	0.00356	0.00063	0.000029	<0.00009	0.00031
S Forebay Sfc	04/29/02	0730	0.0372	0.000376	0.000003	0.00032	0.00092	0.043	0.00000057	<0.00000005	0.00318	0.00089	0.000006	<0.00012	0.00014
S Forebay Btm	04/29/02	0730	0.05	0.000348	0.000007	0.00036	0.00095	0.0085	0.00000077	<0.00000005	0.00362	0.00092	0.000015	<0.00012	0.00024
S Forebay Sfc	05/22/02	0900	0.0203	0.00037	<0.000002	0.00012	0.00132	0.0337	0.00000041	<0.00000009	0.0036	0.00068	0.000008	<0.00007	0.00011
S Forebay Btm	05/22/02	0900	0.0305	0.000371	0.000002	0.00013	0.00115	0.0467	0.00000067	0.00000014	0.00374	0.00069	0.000015	<0.00007	0.00014
S Forebay Sfc	08/19/02	1300	0.0272	0.000617	<0.000008	0.00021	0.00072	0.0459	0.0000003	<0.00000025	0.00408	0.00063	<0.000015	<0.00030	<0.00010
S Forebay Btm	08/19/02	1300	0.0326	0.000609	<0.000008	0.00025	0.00083	0.0528	0.00000031	<0.00000025	0.00456	0.00064	0.000018	<0.00030	0.0002
S Forebay Sfc	09/17/02	1000	0.0267	0.000377	<0.000008	<0.00007	0.00062	0.05	0.00000039	<0.00000025	0.00486	0.00054	<0.000015	<0.00030	0.00011
S Forebay Btm	09/17/02	1000	0.0341	0.000358	0.000036	<0.00007	0.00071	0.0586	0.00000038	<0.00000025	0.00433	0.00054	<0.000015	<0.00030	0.00037
S Forebay Sfc	10/22/02	0840	0.0338	0.000543	<0.000008	0.00011	0.00053	0.0619	0.00000003	<0.00000025	0.00845	0.00048	<0.000015	<0.00030	0.00013
S Forebay Btm	10/22/02	0840	0.046	0.0006	<0.000008	0.00015	0.0006	0.0773	0.00000024	<0.00000025	0.00997	0.0005	<0.000015	<0.00030	0.00018
N Afterbay Sfc	04/02/02	1635	0.0978	0.000419	<0.000003	0.00032	0.00093	0.103	0.00000059	0.00000021	0.00336	0.00075	0.000045	<0.00009	0.0003
N Afterbay Btm	04/02/02	1635	0.113	0.000351	0.000003	0.00039	0.00481	0.156	0.00000096	0.00000032	0.00563	0.00083	0.000064	<0.00009	0.00045
N Afterbay Sfc	04/24/02	0800	0.0464	0.000436	0.000002	0.00031	0.00097	0.0533	0.00000049	<0.00000013	0.00349	0.00075	0.000018	<0.00012	0.00017
N Afterbay Btm	04/24/02	0800	0.0462	0.00045	0.000003	0.00035	0.00103	0.0559	0.00000087	0.00000013	0.0036	0.0008	0.000018	<0.00012	0.00031
N Afterbay Sfc	05/23/02	0930	0.0286	0.000343	<0.000002	0.00019	0.00086	0.0443	0.00000045	0.00000014	0.00391	0.00076	0.000026	0.00008	0.00014
N Afterbay Btm	05/23/02	0930	0.0242	0.000336	0.000002	0.00019	0.00089	0.0407	0.00000053	<0.00000009	0.00415	0.0007	0.00002	<0.00007	0.00019
N Afterbay Sfc	08/19/02	0830	0.0415	0.000536	<0.000008	0.00025	0.0008	0.0669	0.00000034	<0.00000025	0.00486	0.00067	<0.000015	<0.00030	0.00014
N Afterbay Btm	08/19/02	0830	0.0432	0.000535	<0.000008	0.00025	0.00079	0.0708	0.00000036	<0.00000025	0.00492	0.00068	0.000016	<0.00030	0.00017
N Afterbay Btm	09/17/02	1200	0.0325	0.000354	<0.000008	<0.00007	0.131	0.0655	0.00000037	<0.00000025	0.00409	0.00065	<0.000015	<0.00030	0.00038
N Afterbay Sfc	09/19/02	1200	0.0239	0.00035	<0.000008	<0.00007	0.00066	0.0414	0.00000037	<0.00000025	0.00307	0.00049	<0.000015	<0.00030	<0.00010
N Afterbay Sfc	10/22/02	1130	0.0379	0.000585	<0.000008	0.00014	0.00058	0.076	<0.00000015	<0.00000025	0.00895	0.00048	<0.000015	<0.00030	0.00021
N Afterbay Btm	10/22/02	1130	0.249	0.000607	<0.000008	0.00098	0.00108	0.412	0.00000033	<0.00000025	0.0126	0.00128	<0.000015	<0.00030	0.00114

**Appendix 9**  
**Surface Total Minor Element Data**

Station Name	Date	Time	Total Al (mg/L)	Total As (mg/L)	Total Cd (mg/L)	Total Cr (mg/L)	Total Cu (mg/L)	Total Fe (mg/L)	Total Hg (mg/L)	Total MeHg (mg/L)	Total Mn (mg/L)	Total Ni (mg/L)	Total Pb (mg/L)	Total Se (mg/L)	Total Zn (mg/L)
S Afterbay Sfc	04/02/02	1745	0.106	0.00035	<0.000003	0.00033	0.00095	0.126	0.00000059	0.00000021	0.00296	0.00075	0.000056	<0.00009	0.00032
S Afterbay Btm	04/02/02	1745	0.12	0.000385	0.000008	0.00043	1.7	0.294	0.00000091	0.00000027	0.00415	0.00168	0.000192	<0.00009	0.00164
S Afterbay Sfc	04/24/02	0930	0.0761	0.000429	0.000003	0.00044	0.0011	0.0878	0.00000053	<0.00000002	0.00425	0.00089	0.00004	<0.00012	0.00027
S Afterbay Btm	04/24/02	0930	0.083	0.00046	0.000004	0.00047	0.00117	0.0968	0.0000366	0.00000141	0.00417	0.0009	0.000042	<0.00012	0.00036
S Afterbay Sfc	05/23/02	0830	0.0275	0.00034	<0.000007	0.00019	0.00096	0.0394	0.00000051	<0.00000009	0.0033	0.0009	0.000015	0.00008	0.00015
S Afterbay Btm	05/23/02	0830	0.0301	0.000339	<0.000007	0.00026	0.00104	0.0434	0.00000082	0.00000014	0.00328	0.00137	0.000019	0.00009	0.00066
S Afterbay Sfc	08/19/02	0915	0.0545	0.000592	<0.000008	0.00029	0.0008	0.0794	0.00000034	<0.00000025	0.00514	0.00071	0.00002	<0.00030	0.00018
S Afterbay Btm	08/19/02	0915	0.0808	0.000521	<0.000008	0.00037	0.00096	0.1159	0.00000068	<0.00000015	0.00657	0.0008	0.000039	<0.00030	0.00046
S Afterbay Sfc	09/17/02	1315	0.0299	0.000315	<0.000008	<0.00007	0.00066	0.0508	0.00000038	<0.00000025	0.00377	0.00053	<0.000015	<0.00030	0.00012
S Afterbay Btm	09/17/02	1315	0.0378	0.000422	<0.000008	<0.00007	0.0007	0.0603	0.00000048	<0.00000025	0.00404	0.00054	<0.000015	<0.00030	0.00018
S Afterbay Sfc	10/22/02	1215	0.0411	0.000522	<0.000008	0.00013	0.00059	0.0707	0.00000018	0.00000025	0.00875	0.00047	<0.000015	<0.00030	0.00014
S Afterbay Btm	10/22/02	1215	0.036	0.000523	0.00577	0.00014	0.00063	0.117	0.00000024	<0.00000025	0.00921	0.00049	<0.000015	<0.00030	0.0002

ND = Not Detected

Appendix 10  
Surface Dissolved Minor Elements

<u>Station Name</u>	<u>Date</u>	<u>Time</u>	Diss. Al <u>(mg/L)</u>	Diss. As <u>(mg/L)</u>	Diss. Cd <u>(mg/L)</u>	Diss. Cr <u>(mg/L)</u>	Diss. Cu <u>(mg/L)</u>	Diss. Fe <u>(mg/L)</u>	Diss. Hg <u>(mg/L)</u>	Diss. MeHg <u>(mg/L)</u>	Diss. Mn <u>(mg/L)</u>	Diss. Ni <u>(mg/L)</u>	Diss. Pb <u>(mg/L)</u>	Diss. Se <u>(mg/L)</u>	Diss. Zn <u>(mg/L)</u>
N Forebay Sfc	04/02/02	1215	0.0058	0.000367	<0.000003	0.00006	0.00059	0.009	ND	ND	0.00051	0.00047	<0.000010	<0.00009	0.0001
N Forebay Btm	04/02/02	1215	0.0066	0.00033	<0.000003	0.00006	0.00083	0.0086	ND	ND	0.00063	0.00047	<0.000010	<0.00009	0.00021
N Forebay Sfc	04/29/02	0845	0.0052	0.000411	0.000003	0.00028	0.00083	0.0085	ND	ND	0.00119	0.00082	<0.000005	<0.00012	0.00033
N Forebay Btm	04/29/02	0845	0.006	0.000368	0.000002	0.00027	0.00104	0.0089	ND	ND	0.00103	0.00085	<0.000005	<0.00012	0.00019
N Forebay Sfc	05/22/02	1030	0.0024	0.00035	<0.000002	0.00004	0.00068	0.0081	ND	ND	0.00203	0.0006	<0.000005	<0.00007	0.00009
N Forebay Btm	05/22/02	1030	0.00218	0.000407	0.000003	0.00005	0.0554	0.0151	ND	ND	0.00254	0.00061	0.000002	<0.00007	0.00018
N Forebay Sfc	08/19/02	1100	0.0028	0.000467	<0.000008	0.00017	0.0006	0.0068	ND	ND	0.00055	0.00055	<0.000015	<0.00030	0.00017
N Forebay Btm	08/19/02	1100	0.0022	0.000576	<0.000008	0.00017	0.019	0.0068	ND	ND	0.00153	0.0006	<0.000015	<0.00030	0.00017
N Forebay Sfc	09/17/02	0800	0.0024	0.000421	<0.000008	<0.00007	0.00055	0.0082	ND	ND	0.0016	0.00042	<0.000014	<0.00030	<0.00010
N Forebay Btm	09/17/02	0800	0.0016	0.000321	<0.000008	<0.00007	3.540	0.276	ND	ND	0.00159	0.00188	0.000191	<0.00030	0.00113
N Forebay Sfc	10/22/02	0950	0.0037	0.00051	<0.000008	<0.00007	0.00045	0.0082	ND	ND	0.00088	0.00034	<0.000015	<0.00030	0.00015
N Forebay Btm	10/22/02	0950	0.0052	0.000525	<0.000008	<0.00007	0.00053	0.0082	ND	ND	0.00069	0.00033	<0.000015	<0.00030	0.00017
S Forebay Sfc	04/02/02	1415	0.0088	0.000288	<0.000003	0.00007	0.00065	0.0099	ND	ND	0.00036	0.00047	<0.000010	<0.00009	0.0001
S Forebay Btm	04/02/02	1415	0.0055	0.000292	0.000053	0.00007	0.00063	0.0086	ND	ND	0.00035	0.00049	<0.000010	<0.00009	0.0001
S Forebay Sfc	04/29/02	0730	0.0054	0.000348	0.000002	0.00027	0.00077	0.0102	ND	ND	0.00095	0.00085	0.000008	0.00012	0.00029
S Forebay Btm	04/29/02	0730	0.0065	0.000382	0.000004	0.00028	0.00081	0.0106	ND	ND	0.00095	0.00083	<0.000005	<0.00012	0.00021
S Forebay Sfc	05/22/02	0900	0.0029	0.000376	<0.000002	0.00005	0.00073	0.0095	ND	ND	0.00194	0.00058	<0.000001	<0.00007	0.00012
S Forebay Btm	05/22/02	0900	0.0029	0.000371	0.000005	0.00007	0.0112	0.0091	ND	ND	0.0026	0.00091	0.000008	<0.00007	0.0003
S Forebay Sfc	08/19/02	1300	0.0016	0.000548	<0.000008	0.00018	0.00059	0.0055	ND	ND	0.00044	0.00054	<0.000015	<0.00030	<0.00010
S Forebay Btm	08/19/02	1300	0.0022	0.000565	<0.000008	0.00018	0.00069	0.0076	ND	ND	0.00079	0.00056	<0.000015	<0.00030	0.00023
S Forebay Sfc	09/17/02	1000	0.0058	0.000327	<0.000008	<0.00007	0.00058	<0.0035	ND	ND	0.00297	0.00047	<0.000015	<0.00030	0.00018
S Forebay Btm	09/17/02	1000	0.0032	0.000354	0.00016	<0.00007	0.00071	0.0073	ND	ND	0.00194	0.00047	<0.000015	<0.00030	0.00154
S Forebay Sfc	10/22/02	0840	0.0022	0.000565	<0.000008	<0.00007	0.00044	0.0074	ND	ND	0.0003	0.00034	<0.000015	<0.00030	0.00013
S Forebay Btm	10/22/02	0840	0.0042	0.00055	<0.000008	<0.00007	0.00046	0.0096	ND	ND	0.00086	0.00034	<0.000015	<0.00030	0.00012
N Afterbay Sfc	04/02/02	1635	0.0167	0.000374	<0.000003	0.0001	0.00073	0.0125	ND	ND	0.00016	0.00049	<0.000010	<0.00009	0.00014
N Afterbay Btm	04/02/02	1635	0.0225	0.000266	<0.000003	0.00016	0.00245	0.0335	ND	ND	0.00059	0.00052	0.000038	<0.00009	0.00022
N Afterbay Sfc	04/24/02	0800	0.0083	0.000454	0.000001	0.00026	0.00084	0.0115	ND	ND	0.00032	0.00066	<0.000005	<0.00012	0.00014
N Afterbay Btm	04/24/02	0800	0.0092	0.0000421	0.000003	0.00028	0.00083	0.0111	ND	ND	0.00044	0.00065	<0.000005	<0.00012	0.00015
N Afterbay Sfc	05/23/02	0930	0.003	0.000324	<0.000002	0.00006	0.00075	0.0062	ND	ND	0.00084	0.00062	0.000001	<0.00007	0.00034
N Afterbay Btm	05/23/02	0930	0.0043	0.000378	0.000003	0.00005	0.00093	0.0093	ND	ND	0.00158	0.00087	0.000004	<0.00007	0.00075
N Afterbay Sfc	08/19/02	0830	0.0019	0.000488	<0.000008	0.00016	0.00063	0.0072	ND	ND	0.0003	0.00055	<0.000015	<0.00030	<0.00010
N Afterbay Btm	08/19/02	0830	0.0024	0.00046	<0.000008	0.00017	0.00102	0.0081	ND	ND	0.00056	0.00065	<0.000015	<0.00030	0.0173
N Afterbay Sfc	09/17/02	1200	0.0023	0.000397	<0.000008	<0.00007	0.00079	0.0056	ND	ND	0.00152	0.00044	<0.000015	<0.00030	<0.00010
N Afterbay Btm	09/19/02	1200	0.0024	0.000369	<0.000008	<0.00007	0.00056	0.006	ND	ND	0.00114	0.00039	<0.000015	<0.00030	<0.00010
N Afterbay Sfc	10/22/02	1130	0.0016	0.000547	<0.000008	<0.00007	0.00046	0.0087	ND	ND	0.00114	0.00033	<0.000015	<0.00030	0.00025
N Afterbay Btm	10/22/02	1130	0.0016	0.000536	<0.000008	<0.00007	0.00043	0.0149	ND	ND	0.00053	0.00037	<0.000015	<0.00030	<0.00010

Appendix 10  
Surface Dissolved Minor Elements

<u>Station Name</u>	<u>Date</u>	<u>Time</u> (PST)	Diss. Al (mg/L)	Diss. As (mg/L)	Diss. Cd (mg/L)	Diss. Cr (mg/L)	Diss. Cu (mg/L)	Diss. Fe (mg/L)	Diss. Hg (mg/L)	Diss. MeHg (mg/L)	Diss. Mn (mg/L)	Diss. Ni (mg/L)	Diss. Pb (mg/L)	Diss. Se (mg/L)	Diss. Zn (mg/L)
S Afterbay Sfc	04/02/02	1745	0.0175	0.000325	<0.000003	0.00007	0.00073	0.0121	ND	ND	0.00011	0.00045	<0.000010	<0.00009	0.00014
S Afterbay Btm	04/02/02	1745	0.0283	0.000366	<0.000003	0.00008	0.00204	0.0212	ND	ND	0.00029	0.00051	<0.000010	<0.00009	0.00013
S Afterbay Sfc	04/24/02	0930	0.0151	0.0004	0.000002	0.00028	0.00087	0.0119	ND	ND	0.00027	0.00066	<0.000005	<0.00012	0.00013
S Afterbay Btm	04/24/02	0930	0.0161	0.000417	0.000004	0.00028	0.00091	0.0145	ND	ND	0.0005	0.0007	0.00006	<0.00012	0.00065
S Afterbay Sfc	05/23/02	0830	0.0034	0.000331	<0.000007	0.00028	0.00089	0.0089	ND	ND	0.00074	0.00084	<0.000007	0.0001	0.00019
S Afterbay Btm	05/23/02	0830	0.004	0.000295	<0.000007	0.00019	0.00089	0.0066	ND	ND	0.00152	0.00085	<0.000007	0.00019	0.00028
S Afterbay Sfc	08/19/02	0915	0.0023	0.000494	<0.000008	0.00017	0.00062	0.0076	ND	ND	0.00032	0.00054	<0.000015	<0.00030	<0.00010
S Afterbay Btm	08/19/02	0915	0.0021	0.000565	<0.000008	0.00018	0.00107	0.0081	ND	ND	0.00052	0.00057	<0.000015	<0.00030	0.00083
S Afterbay Sfc	09/17/02	1315	0.002	0.000348	<0.000008	<0.000007	0.00058	0.0065	ND	ND	0.00164	0.00047	<0.000015	<0.00030	0.00024
S Afterbay Btm	09/17/02	1315	0.0021	0.000359	<0.000008	0.00017	0.0006	0.0095	ND	ND	0.00166	0.00044	<0.000015	<0.00030	0.00012
S Afterbay Sfc	10/22/02	1215	0.002	0.000483	<0.000008	<0.000007	0.00044	0.0078	ND	ND	0.00044	0.00034	<0.000015	<0.00030	0.00039
S Afterbay Btm	10/22/02	1215	0.002	0.000452	0.00797	<0.000007	0.00052	0.0457	ND	ND	0.0057	0.00035	<0.000015	<0.00030	0.00017

ND = Not Detected